

### **REMARKS**

In the Office Action, claims 1-24 were rejected. By the present Response, the claims are amended as discussed below. All pending claims are believed to be clearly allowable. Reconsideration and allowance of all pending claims are requested.

#### **Claim modifications**

In the present Response, certain amendments have been made to claims 1-24. These changes correct punctuation. No substantive changes have been made that would change the patentability.

#### **Rejections under 35 U.S.C. § 102(b)**

The application includes four independent claims, notably claims 1, 6, 14, and 17. Independent claims 6, 14, and 17 were rejected under 35 U.S.C. § 102(b) as being anticipated by Breimesser et al. (U.S. Patent 5,622,177, hereinafter "Breimesser"). Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration. Applicants respectfully assert that the present invention, as claimed in independent claims 6, 14, and 17, is patentable over the Breimesser reference.

#### **Claims 6 and 17:**

Independent claims 6 and 17 were rejected under 35 U.S.C. § 102(b) as being anticipated by Breimesser. Claims 6 and 17 are clearly distinguishable from the teachings of Breimesser. In particular, as recited in claim 6, the Breimesser reference does not teach, disclose or suggest at least "*a time-domain multiplexer having an input connected to each of the plurality of ultrasonic array outputs and having a multiplexer output wherein the time-domain multiplexer continually cycles through each of the plurality of ultrasonic array outputs at a predetermined frequency connecting each of the plurality of ultrasonic array outputs to the multiplexer output for a predetermined amount of time*".

Similarly, as recited in claim 17, the Breimesser reference does not teach, disclose or suggest at least “*continually cycling through each of the plurality of ultrasonic array outputs at a predetermined frequency to connect and transmit the ultrasonic data from each of the plurality of ultrasonic array outputs to at least one multiplexer output for a predetermined amount of time*”.

It is clear that in the invention thus claimed, the ultrasonic array outputs are fed to the time-domain multiplexer, which multiplexes these received inputs to transfer the received data. This is made clear in the following excerpt from the summary of the application:

A timing reference is connected to the time-domain multiplexer, the demultiplexer and the analog to digital converter. The timing reference provides a single timing reference to determine at least the predetermined frequency and the sample frequency rate. See e.g., application (in its published form, US 2002/0167971 A1), paragraph [0005], last 2 sentences.

This is made even more clear later in the application, where one reads:

The ultrasonic array outputs 210 are connected to the time-domain multiplexer 114 that includes a multiplexer switching element 220 that is connected to the timing reference 180. The multiplexer switching element 220 continually cycles through the ultrasonic array outputs 210 at a predetermined frequency to connect each of the ultrasonic array outputs 210 to the multiplexer output 230 for a predetermined amount of time. See e.g., application paragraph [0016], third and fourth sentences.

Thus, it is clear that claims 6 and 17 recite time-multiplexing of the received data after reception in addition to time-multiplexing of the data to be transmitted, via a single time reference. That is, the multiplexer cycles through outputs of the array for signal reception.

In contrast, Breimesser teaches utilizing starting-time lines for multiplexing the transmission (not reception) of ultrasonic signals. In particular, as set forth in column 2, lines 45-48 of Breimesser:

The transmit pulsers are connected to the base unit via a number of individual starting-time lines required for transmitting the digitally coded starting times for the transmit pulses.

Furthermore, Breimesser specifically teaches that the starting times are provided to the transmit pulser. According to Breimesser, in column 3, lines 18-20:

In the transmit mode, the control device 20 transmits transmit pulses for the transducer elements  $E_{ij}$  with individually specified starting times  $t_{ij}$ .

Thus, Breimesser teaches utilizing start timings for controlling transmission of ultrasonic signals from the transducer elements to a patient. The transmission (reception) of sensed signals is handled altogether differently, however. For those signals, from the transducer elements to the multiplexer 22, no timing signals at all are required or used. Thus, the start times are *not* used to control the reception of the ultrasonic signals. Breimesser does not, therefore, teach a multiplexer that cycles through the outputs of the sensor array (transducer elements). Therefore, the present invention, as claimed in independent claims 6 and 17 are not anticipated by the Breimesser reference. Thus, it is respectfully requested that the rejection of claims 6 and 17 and their dependent claims under 35 U.S.C. §102(b) be withdrawn.

Claim 14 and claims depending therefrom:

Independent claim 14 was also rejected under 35 U.S.C. § 102(b) as being anticipated by Breimesser. Claim 14 has been amended as discussed below. Claim 14 is clearly distinguishable from the teachings of Breimesser. In particular, the Breimesser reference does not teach, disclose or suggest at least “amplifying the ultrasonic data in the

plurality of de-multiplexer outputs; and *converting the amplified ultrasonic data to digital ultrasonic data* at a sampling frequency rate”, as recited in amended claim 14. That is, the de-multiplexer receives analog signals that are amplified and these amplified signals are converted to digital values.

However, it appears that the signal output, as taught by Breimesser, is digital, because the address lines and control lines carry digital data. In particular, as set forth in column 2, lines 38-45 of Breimesser:

The digital control device is connectable to each transducer element of the array. In this control device, a transmit pulser is allocated to each transducer element, and a shared address decoder for addressing the transmit pulses is allocated to these transmit pulsers. The address decoder is connected to the base unit via a number of address lines that are required for transmitting the digitally coded addresses.

Therefore, if the signal output is already digital, there is no need for analog-to-digital conversion in the base unit. Therefore, the present invention, as recited in independent claim 14, is not anticipated by the Breimesser reference. Thus, it is respectfully requested that the rejection of claim 14 and its dependent claims under 35 U.S.C. §102(b) be withdrawn.

**Rejections under 35 U.S.C. § 103(a)**

**Claim 1 and claims depending therefrom:**

Independent claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Breimesser in view of Engeler et al. (U.S. Patent 5,566,133, hereinafter “Engeler”). Claim 1 is clearly distinguishable from the teachings of Breimesser. In particular, the Breimesser reference does not teach, disclose or suggest at least “a time-domain multiplexer having an input connected to each of the plurality of ultrasonic array outputs and having a multiplexer output, *the time-domain multiplexer continually cycles through*

*each of the plurality of ultrasonic array outputs at a predetermined frequency connecting each of the plurality of ultrasonic array outputs to the multiplexer output for a predetermined amount of time, wherein the plurality of ultrasonic array outputs comprises a first number of outputs and the multiplexer output comprises a second number of outputs, the first number of outputs being greater than the second number of outputs”.*

As discussed previously, in the invention as recited in claim 1, the ultrasonic array outputs are fed to the time-domain multiplexer, which multiplexes these received inputs to transfer the received data. However, Breimesser teaches utilizing starting-time lines for multiplexing the transmission of ultrasonic signals (to a patient). These start times are *not* used to control the reception of the ultrasonic signals. Thus, Breimesser’s multiplexer does not cycle through the transducer elements during reception of ultrasonic signals.

Moreover, Breimesser does not teach, disclose or suggest at least “*a time gain control amplifier connected to each of the plurality of de-multiplexer outputs and amplifying each respective signal in each of the plurality of de-multiplexer outputs; and an analog to digital converter connected to the time gain control amplifier, wherein each respective signal in each of the plurality of de-multiplexer outputs is converted to a digital signal at a sample frequency rate*”.

As taught by Breimesser, and as discussed previously, it appears that the signal outputs of the multiplexer are digital, because the address lines and control lines carry digital data. Therefore, there is no need for an analog-to-digital converter in the base unit.

Furthermore, Engeler teaches the analog-to-digital converter being utilized for converting analog signal into digital outputs. Because the data already appears to be digital in Breimesser, there is no motivation to combine the Breimesser and Engeler references. Applicants, therefore, respectfully submit that independent claim 1 and

claims depending therefrom are allowable and respectfully request the Examiner to reconsider the rejection of the claims.

**Conclusion**

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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